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# SCIENCE TRENDS

HIGHLIGHTS

- \* Fallout Control?
- \* NASA R&D Contracts
- \* Navy Tactical Data System
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## Strontium 90 Fallout Control

Government-sponsored survey by Stanford Research Institute made public this week by the Atomic Energy Commission raises the technical possibility of counteracting past as well as future strontium-90 fallout from nuclear weapons tests. A variety of conceivable methods have been examined and avenues for future research are outlined.

- \* **Objectives:** Study has been aimed at development of control measures that could be applied to the fireball or cloud following an atomic explosion, for the purpose of "reducing or eliminating" human intake of fission products -- particularly the long-lived and hazardous strontium-90.
- \* **Methods Considered:** The Stanford study concluded that there are possible control methods in two broad areas -- a change in the physical characteristics of strontium 90 fallout mechanism and measures based on chemical addition or modification of strontium-90-bearing particles and debris.
- \* **Changes in Physical Characteristics:** The Stanford Study deems "not possible" suggestions that strontium-90 might be altered so that it remains in the stratosphere for several hundred years to permit decay. However, it is regarded as possible to restrict fallout from surface bursts to the immediate detonation area. World-wide fallout might be prevented in this fashion by "scavenging" the bomb cloud with sand carried from the surface or applied following detonation by planes or rockets. It is believed that, by making the strontium-90-bearing particles large enough, they could be made to deposit locally within a restricted area.
- \* **Changes in Chemical Characteristics:** The study finds "no known possibility" of changing strontium-90 to a gaseous form to increase storage time in the atmosphere. More hopeful, the report indicates, is a means of changing the solubility or reactivity, perhaps through inorganic or organic compounds.

One intriguing possibility raised by the report is the adding of organic reagents continuously to the stratosphere in the form of aerosols. If feasible, it is stated "this would have the added advantage of counteracting past accumulations of strontium-90 as well as future ones." Chemical costs of such a venture are estimated to be on the order of \$1 billion a year.

Another possibility is the coating of strontium-90 with some impervious material. Silver and silver chloride are mentioned as potential coating agents as well as plastics or hydrocarbons. Survey states that "coatings might be applied either by additions to the bomb or by external additions to the fireball or cloud."

## NASA Research and Development

Some \$16 million in new contracts awarded by the National Aeronautics and Space Administration include R&D on a lunar seismograph, studies of a "plug-nozzle" engine by General Electric and a "unique" solid propellant rocket design by Grand Central Rocket Co.

- \* Lunar Seismograph: Columbia University and California Institute of technology each receive \$130,000 for vertical and/or three-component lunar seismograph systems which, if feasible, may be landed on the moon within five to six years. Instruments will study possible "moonquakes" or natural seismic disturbances as well as lunar background noise which might be caused by thermal stresses and micro-meteorite impacts.

Seismometer, weighing less than 10 or 20 pounds, must observe both seismic body waves and surface waves. Available long-period galvanometers, normally used to obtain high sensitivity at low frequencies are considered too delicate for rocket use. Means under consideration to provide the low-pass filtering normally accomplished by the galvanometer include electromechanical feedback, or direct thermal, mechanical or electrical filtering.

Dr. Maurice Ewing, Director of the Columbia-Lamont Observatory suggests that methods of coupling the seismograph output to the telemetering system and subsequent analysis of the telemetered data might require a digital output rather than the normal analog recording. Signal power will be limited by the size of the suspended mass of the seismometer, requiring a high impedance transducer to obtain high sensitivity. Contracts may total \$1 million by completion.

- \* Plug Nozzle Engine: NASA will finance a \$390,000, eight-month study by General Electric Propulsion Division of the "plug-nozzle" rocket engine which "spikes" the conventional central opening in the nozzle so that combustion takes place in a ring of cells about the rocket base. In leaving the combustion chambers, exhaust gases would follow the contour of the conical spike. Theory holds that the departure of the gases would be self-adjusting according to altitude. Concept may be test-employed in the initial booster stage of a multi-state rocket. If successful, according to NASA, the study may provide information for the scaling of rocket engines to the multimillion pound thrust category. GE contract calls for proportion and operation estimates.
- \* Solid Propellant Engines: NASA will finance a \$180,000 study by Grand Central Rocket Co., Redlands, Calif. for an extremely high-mass-ratio solid propellant rocket motor described by the company as "revolutionary." Techniques and components are of an advanced nature and are classified because of possible military implications. NASA is interested in the motors for possible application as a terminal stage in space propulsion systems.

Other R&D contracts: Army Ordnance Missile Command, \$150,000 for study of soft lunar landings; MIT, \$100,000 for a prototype instrument to measure plasma density between the Earth and the Moon and particularly around the Moon; Naval Research Laboratory, \$80,000 for instrumentation to measure the natural radioactivity of the Moon and for a lunar data acquisition and recording system. NRL will also begin preliminary design work on advanced detectors to measure ultra-violet radiation, principally, in space.

## Navy Tactical Data System

Vice Admiral John T. Hayward envisions a "tremendous impact" upon naval operations through successful development of a new Naval Tactical Data System (NTDS). The system is undergoing research, test and evaluation at the Naval Electronics Laboratory.

- \* Objectives: NTDS is being developed to meet the complex, high speed and load stress problems of tactical combat direction. Functionally, it coordinates the collection of data from many sources aboard ship including Sonar, Radar, Identification Friend or Foe (IFF), Electronic Counter Measures (ECM) as well as Navigation and Communications.
- \* Basic Operation: NTDS, according to Adm. Hayward, will gather this data, correlate it into a clear picture of the tactical situation, process data as required to substantially aid the decision-making process and then communicate the action-decisions to the selected weapon system.
- \* Computer Units: One standard computer will be used as a computer building block in the NTDS. Installations that require computer capacity exceeding one unit will utilize two or more computers.

Standardization of computers can be achieved irrespective of the varying installation requirements. A digital, general purpose stored program computer will be used, having a high-speed random access memory. The memory contains nearly one million elementary quanta of information or bits. Thirty such bits, comprising a computer word, may be extracted from any location in the memory in only 2.5 millionths of a second.

- \* Development Philosophy: The Navy is approaching this system with a design philosophy to cope with the foreseeable problems that might be imposed on a large tactical data system, as a consequence of eventual changes in weapon tactics and, in general, the evaluation changes in future tactical environments.

## Weapon System Development

Here are some of Adm. Hayward's thoughts on the general problem of weapon system development and management:

"It is essential, we believe, that in going to systems one must have done his component work far enough in advance to have reasonable assurance that the system can be put together.

"Too often, in the past, we have spelled out systems and called for advances in the state-of-the-art that were clearly impractical and in effect forced us to invent on schedule. We never met the schedule. There are any number of such systems as examples in the services.

"There has been a lot of talk about lack of decision in weapon system development causing delays. If one looks closely you will see that delays have usually been caused by the fact that we were attempting to invent on schedule or projecting the state-of-the-art so far ahead that it was obviously impossible to accomplish. This is what we are trying to prevent in the Navy."



## RESEARCH CHECKLIST

- ( ) Gamma Ray Fallout: National Bureau of Standards has studied the shielding properties of concrete against gamma-ray fallout from two nuclear explosions at the Nevada Proving Grounds. The study is one of the first attempts to make field measurements of fallout in arrangements which lend themselves to a theoretical approach, and is expected to be important in the development of radiation shelters.

(Report available. Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Tech. Report No. STR 2375)

- ( ) Electron Tube Research: Naval Research Laboratory has designed and built a secondary-emission electron multiplier tube to help meet the need for pulse amplifiers with high current output and short rise times. Severe power-supply limitation required that the tube normally be cut off except when a positive input signal is applied. The tube can deliver an output pulse of five amperes into a load impedance of 100 ohms with a rise time of less than 100 millimicroseconds.

(R&D by Electronics Division, Electron Tubes Branch, U.S. Naval Research Laboratory, Washington 25, D.C. NRL Problem No. R06-10)

- ( ) Brazing Titanium Sandwich Construction: The feasibility of fabricating titanium alloy face sheet honeycomb sandwiches by brazing techniques has been investigated by the Illinois Institute of Technology for the U.S. Air Force. A quartz lamp radiant heat brazement process developed for titanium alloy face sheet materials and sandwich panel production was found to have a number of advantages over other furnace retort methods.

(Abstract and related information available. Free. Write Service Department, Washington SCIENCE TRENDS, 1120 National Press Building, Washington 4, D.C.)

- ( ) Missile Re-Entry Problems: Tests conducted by the Air Force have demonstrated that reinforced plastic test samples, shaped into miniature missile nose cones, are highly resistant to heat. In a simulated missile re-entry into the earth's atmosphere the plastics successfully endured 15,000° F. for 30 seconds.

(Studies by Wright Air Development Center, Air Research and Development Command, Dayton, Ohio)

- ( ) Elastic Scattering of X-Rays: The Air Force has sponsored studies of the elastic scattering of x-rays as part of an overall-program directed at understanding the basic interactions of x-rays with matter in general. The work is said to be of particular significance in studies of the so-called "giant resonance, a hump on the cross-section or the probability for x-ray absorption.

(Report available. Free. Write National Bureau of Standards, Office of Technical Information, Washington 25, D.C. for Summary Technical Report No. 2372)

- ( ) Solid Propellant Fire Extinguisher: Naval Research Laboratory has developed a solid-propellant pressurizer for a 300-gallon fire sprinkler system for use at Polar temperatures. A solid, double-base compound with long-term storage stability and satisfactory burning characteristics was selected. The propellant grain is a single, vertically perforated cylinder restricted on the outer circumference by a layer of cellulose acetate.

(R&D by Inorganic and Nuclear Chemistry Branch, Chemistry Division, U.S. Naval Research Laboratory, Washington 25, D.C.)

- ( ) Liquid Hydrogen Storage: National Bureau of Standards is developing new multi-layer insulations for storage and transfer of liquid parahydrogen with heat transfer rates said to be one-tenth those of presently-used pearlite powder systems under similar vacuums. The new insulation systems are said to be so efficient that support members for the inner containers account for most of the heat leak. Improved use of materials such as dacron or nylon, instead of stainless steel, may eliminate this difficulty.

(R&D by Cryogenic Engineering Lab, National Bureau of Standards, Boulder, Colo.)

- ( ) Plastic Glue: A plastic "glue" designed to repair damaged bones and put a patient back on his feet in 48 hours is under development by the Army Medical Service. The plastic, a polyurethane polymer, is a foam which solidifies into a porous rigid substance when applied to a fracture. Bones are bonded together until bone cells grow through and replace the plastic. Long-range effects on the body are being studied with the aid of radioisotope tracers.

(Evaluation conducted by Department of Experimental Surgery, Walter Reed Army Institute of Research, Washington 25, D.C.)

- ( ) Mercury Research: U.S. Bureau of Mines intends to study the leaching of cinnabar -- the principal ore of mercury, during the next year. In addition to analyzing factors that influence dissolution of cinnabar, metallurgists will evaluate the use of electro-osmosis for forcing a solvent through rocks for in-place leaching and concurrent deposition of pure mercury from solution.

(R&D by Laboratory, U.S. Bureau of Mines, Albany, Oregon)

- ( ) Yttrium Recovery Process: An economical commercial process for the recovery of yttrium wastes has been developed under Atomic Energy Commission sponsorship. The waste products are first converted to an impure yttrium oxide which is then dissolved in nitric acid. Addition of ferrocyanides and other materials results in an yttrium oxalate which can be calcined and introduced into the regular production process at an estimated cost of \$1.50 per pound.

(R&D by Ames Laboratory, Iowa State College, Ames, Iowa)

### PUBLICATION CHECKLIST

- ( ) Goal Research: An illustrated report on fundamental and applied research dealing with coal, including material on combustion, mining and storage. Covers technological progress during 1957. Just Published. Free. (Write Publication-Distribution Section, U.S. Bureau of Mines, 4800 Forbes Avenue, Pittsburgh 13, Pa. for Inf. Circular 7905)
- ( ) Materials Research: A symposium on research frontiers in the field of high-performance materials. 48 pages. \$2. (Write American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.)
- ( ) Nuclear Electronics: The first volume of the proceedings of the International Symposium on Nuclear Electronics, Paris, 1958. Covers 50 papers on such subjects as scintillation radiation counters, pulse techniques, gamma ray spectrometers and similar devices. \$4. (Order from International Atomic Energy Agency, Karntnerring 11 Vienna 1, Austria)
- ( ) Sunspots: A technical report on field strength recordings made in the U.S. of B.B.C. TV stations in London and Scotland during the 1957-1958 sunspot cycle peak. Free. (Write Technical Research Division, Federal Communications Division, Room 2211 New Post Office Building, Washington 25, D.C. for T.R.R. No. 2.5.8)
- ( ) Soviet-U.S. Science Exchange: The complete text of agreements calling for exchange of U.S. and Soviet scientists in a number of fields. 11 pages. Free. (Write Information Office, National Academy of Sciences, 2101 Constitution Avenue, Washington 25, D.C.)
- ( ) Ordnance Safety Manual: A newly revised loose-leaf manual concerning the hazards of explosives and ammunition and safety regulations of the Army Ordnance Corps. 811 pages. \$2.75. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. No. D 105.6/2:7 -224/rep.)
- ( ) Cancer: An excellent Senate Report outlining facts and figures on cancer and its occurrence in the U.S. and abroad. 40 pages. Free. (Write Committee on Government Operations, U.S. Senate, The Capitol, Washington 25, D.C.)
- ( ) Science Education: The report of the so-called Killian Committee on education for the sciences and engineering. 36 pages. 20 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. No. PR 34.2:Sci 2/3)
- ( ) Fission: A bibliography listing references on the subject of fission from 1952 to 1958 from a number of sources. 208 pages. \$3.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for LAMS 2302)
- ( ) Radiation Monitoring Handbook: A new and revised edition of a handbook prepared at the Los Alamos Scientific Laboratories including material on recent changes in permissible exposures and body burden levels. 180 pages. 60 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. No. Y3.At 7:22/LA -1835/3d ed)
- ( ) IGY Rocketry: Details and flight summaries of the U.S. Rocketry Program in connection with the International Geophysical Year. Covers the period July 5, 1956 to June 30, 1958. 193 pages. \$1. (Write Publication Office, National Academy of Sciences, 2101 Constitution Avenue, N.W. for IGY Rocket Series, No. 2)

